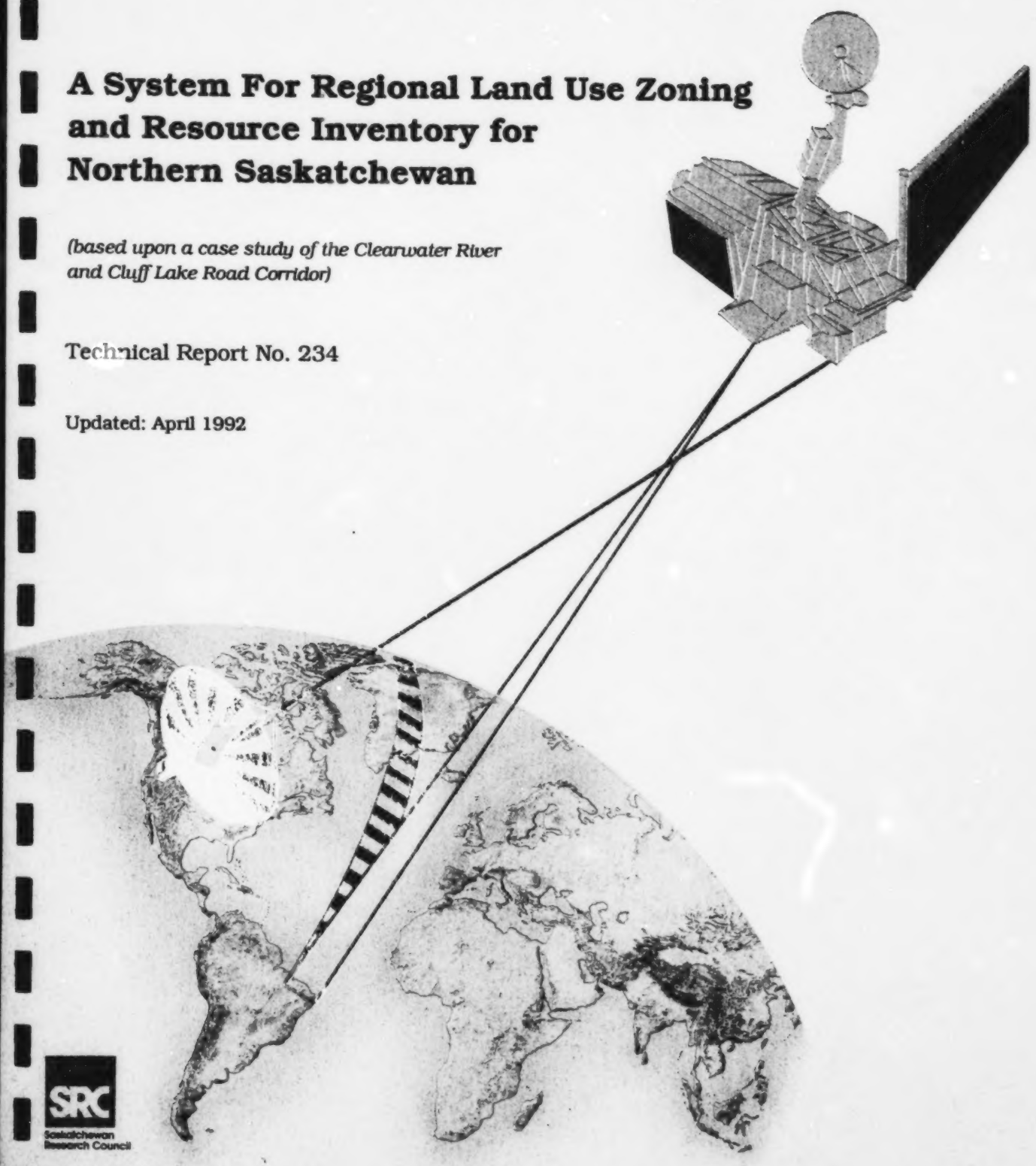
A System For Regional Land Use Zoning and Resource Inventory for Northern Saskatchewan

(based upon a case study of the Clearwater River and Cluff Lake Road Corridor)

Technical Report No. 234

Updated: April 1992



SRC
Saskatchewan Research Council

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Authors:

J. Whiting, Spatial Information Division, Saskatchewan Research Council
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ABSTRACT

To enable decisions to be made in planning, the degree of compatibility must be obtained between the multiple uses of the land, and the land use and natural determinants. In addition, the impact of the development must be shown. McHarg (1969) developed such a system, and this has been adapted to fit northern conditions. An example was prepared for the Western Side (Figure 4.1). This figure is in matrix form with prospective land uses of each coordinate. Each land use was then tested against all others to determine the compatibility, incompatibility and any intervening degree.

A single optimum development was re-examined and the degree of compatibility with other prospective land uses was determined. For example, an area compatible with water sports in recreation would also be compatible with vacation subdivision and forestry (hardwood), but incompatible with open-pit mining.

The map system produced (Figure 3.1) consists of maps giving single use or towards a single aim (conservation, passive and active recreation). These have an existence in their own right, but we seek to find only intrinsic single uses, but also compatible coexisting ones and areas of competition. We can then take complementary pairs and reduce them to simple maps. Trapping and timber harvest can be incorporated into a single map of wildlife suitability. Active and passive recreation can be combined into a single one of recreational suitability.

We then have a residuum of three maps - conservation, recreation and harvesting - which must be resolved. The single suitabilities could be represented using tones of grey or colour digital GIS maps. We can employ colour. Let us allocate yellow to conservation and reconstitute the tones of grey into a range of brightness. We will map recreation in grades of blue and harvesting in grey. Where a land use has no conflict, nor is it complementary, we can map the area in an appropriate colour and in a scale of brightness appropriate to its value. Where there are complementarities, such as recreation and conservation, the combination of blue and yellow will produce green and the brightness will reflect the degree of value. The combination of grey and blue - urbanization and recreation - will show in the blue-grey range, while a coequal suitability for all three classes will result in the combination of grey, blue and yellow, producing a range of grey-greens.

In the preparation of the final map, it is often impossible to resolve the suitabilities, compatibilities and conflicts by superimposition and photography. The preemptive method will have to be used. This would consist of locating all primary suitabilities not in competition with any other primary values and mapping them, thus preempting the appropriate areas. This is continued with secondary and tertiary values until the summary map shows all unitary, complementary and competing intrinsic land uses. Those shown as coequally suitable for more than one use may either compete or coexist.

We can abandon absolute economic values that cover only a small range of price values. Further, we can employ a relative system to include all the important factors that defy pricing by economists. While this denies an illusory precision of cost-benefit economics, it does show the relative concurrence of positive factors and their relative absence. Although we are unable to fix precise money values on these, it is safe to assume that, without any supervening value, the concurrence of the positive factors in any one location does show its intrinsic suitability for the land use in question.

Another value is that the information, so compiled and interpreted, form the base data required to subject any planning proposal to the test of least cost-maximum benefit. The values of the area in question for the major land uses have been identified, and the degree to which any proposal will destroy or enhance these can be demonstrated. Moreover, these same data simplify the quest for least-social-cost locations. By making explicit the factors employed, society at large and for individuals, can insist that the development process, both public and private, respond to these values.

A most useful purpose would be served, if maps of the value of an area, and the intrinsic suitabilities, were made public. Developers could then know the conflict where they planned to tread and, more positively, could be led to areas intrinsically suitable for their energies. Perhaps one of the most valuable innovations of the method is the conception of complementary land uses, the search for areas that can support more than one use. This tends to be in conflict with the principle of zoning, which enforces segregation of land uses. The recognition that certain areas are intrinsically suitable for several land uses can be seen either as a conflict or as the opportunity to combine uses in a way that is socially desirable.

Certain technical problems are inherent in the method. The first of these is the ensurance of parity of factors. The results need to be qualified if the factors are of disproportionate weights. The GIS computer can resolve this problem.

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PREFACE

The project was carried out in three phases to produce a detailed plan for the best use and allocation of land and resources within the study area.

Volume 1 (Phase I)

1. The Saskatchewan Research Council will prepare a model for resource inventory and capability classification for the study area.

   (a) SRC will use a readily-available map scale series (e.g. (1:250,000) to plot the results in visual form, with a suitable legend;

   (b) SRC will identify all data sources and describe their applicability;

   (c) the model will be prepared with particular reference to the resources and resource uses in Northern Saskatchewan;

   (d) the model should be applicable in other areas of the Northern Administration District as a data gathering and planning tool.

Volume 2 (Phase II)

1. The Saskatchewan Research Council will compile and map resource inventory and capability for the study area, using the format developed in Phase I and including:

   (a) an analysis of landscape patterns (forests, soils, water bodies, etc.);

   (b) an inventory of present land and resource use commitments;

   (c) an inventory of the historical, biological, cultural, man-made and natural attributes of the area;

   (d) a description of present land and resource use patterns;

   (e) a description of potential land and resource uses, and an estimation of future conflicts;

   (f) a description of the capability of the resource base to support the various activities.

Volume 3 (Phase III)

Upon satisfactory completion of the resource inventory, SRC will produce a detailed plan for the use and

allocation of land and resources within the study area, including:

(a) identification of development areas, and development guidelines for various activities (e.g. commercial tourism, public recreation, commercial, residential, recreation - residential, highway services, etc.);

(b) guidelines for land allocation;

(c) a mechanism for resolving land or resource-use conflicts;

(d) identification of single use areas (e.g. potential parks) for further detailed study;

As it was necessary to borrow information from numerous secondary sources, the various chapters are introduced by citing the sources to avoid confusion on the part of the client. For example, certain sections from the Bayda Inquiry Report, Fraser Symington's discussion of integrated development based on appropriate technology, and the canoeing potential of the Clearwater River, are accompanied by a description of the original study or report. Since the final report is the product of several authors, it was found advisable to cite the chapter author in the Table of Contents. This enables the client, or other future readers, to easily identify the source for clarification or further information on the topic. Another useful method of source identification can be found in the brief bibliography of data sources at the beginning of each section. The final report was organized in this fashion, so that the client knows who to contact for clarification if necessary, and will also note that the section has some basis beyond personal opinions on the matter, since the content is rather speculative.

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1.0 RESOURCE INVENTORY AND LAND USE CAPABILITY CLASSIFICATIONS FOR NORTHERN SASKATCHEWAN

1.1 Introduction

If "the North" is to be truly developed, it must be in a balanced and nondestructive manner. However, the North is largely an unknown and unspoiled area. The organization of information, with some degree of analysis, is needed as an aid to planned development. This report examines existing classification systems, documents criticisms based upon their general value for northern Canada and especially northern Saskatchewan. Corridor Studies and Environmental Impact Assessment could be assessed with the suggested procedure.

1.2 Classification Systems Used for Planning: General Considerations

1.2.1 Definitions

Planning for development involves planning for future land use. This process requires information both on the landscape (biophysical data), and on the probable users of the landscape (socioeconomic data). Although it requires much effort, the collection and classification of biophysical data is fairly straightforward and it can b efficiently represented in map and text form. Socioeconomic information varies from kinds that are confined to an area, such as present land use and trends in land use, to those which may originate in populations outside of the area, only the general effect of which may be determined. Examples of the latter are those which affect demand, such as population size, composition, mobility, etc.. Those affecting preferences are: those altering education and culture, and those which limit possible use, such as access, available technology, and familiar methods of development and use. It is generally more difficult to integrate socioeconomic data into a classification system, because it is more complex and difficult to define, and can change very rapidly.

Thus, the simplest systems used in planning deal largely with biophysical characteristics. As more socioeconomic information is incorporated, the systems become more complex. GIS is now a practical system designed for full integration of all data, although computer systems. Midway in complexity are the resource inventory and land use capability system, which for this paper will be called use capability systems.

Resource inventory and land use capability classification are closely related procedures. The former involves the evaluation mainly of biophysical characteristics of the landscape for their usefulness to man. Those which may be useful are best not regarded as resources, but only potential, because a resource is what man makes it, or what use man makes of it. Land use capability classification goes further in considering these potential resources for their combined value for a particular use. It also should consider the impact of use, the social and environmental limitations or drawbacks. Thus, both potential resource analysis and inventory, and land use capability classification evaluate areas of the landscape for potential use, considering specific socioeconomic factors.

1.2.2 The Regional Concept

Those who know Canada's north know it is not homogenous, but best regarded as a series of regions. Regions are defined as having less internal variations than there is between them, on some particular basis. A region by some definition is conceded to be the most logical basis for planning, largely because the tasks of classification and planning are simpler where some factors are constant over the whole area.

This would be especially useful for socioeconomic factors, but these often cannot be confined to or defined for an area. Political jurisdiction definitely can be however, and this is a very important practical factor in planning. Northern Saskatchewan could be considered a region with an administrative basis: its administrative status under the present Department of Northern Saskatchewan would facilitate planned development, which in turn could further unify the region (Figure 1.1).

The limited area of a region, whatever its basis, will have a limited range of characteristics, some of them unique, both biophysical and socioeconomic. This is especially true for Canada's north (as compared to the south) in varying degree: methods and experience in development originating in the south could unheedingly and unnecessarily destroy much potential without this knowledge. Any system, for regional planning, must be designed around or adapted to the range of characteristics of the region, for best usefulness.

The basic design of a system may limit its adaptability to other regions, however. The Canada Land Inventory (CLI) system, for instance, was designed to be applied to southern Canada, but it has problems of suitability in the diverse regions of southern Canada. To make the system reasonably useful, in fact, regional compromises had to be made: for example, the value of a Saskatchewan hill for skiing was not the value given to a similar hill in British Columbia. The difference was due to both the physical characteristics of the regions (relative scarcity of ski hills), and the socioeconomic factors (related to demand for a quality expected of ski hills). The basic design of the CLI was not directed towards regional adaptation, and thus proved inflexible in this regard.

1.2.3 Data and Detail Limitations

More information is preferable to less information. Information is limited by the extent of previous data gathering and analysis, and the resources and skills further available in the immediate future. For the usual type of survey utilizing satellite and air photo interpretation plus fieldwork, more data is derived from more fieldwork, and may be enhanced with larger-scale or more specialized (colour, infrared, etc.) air photography. In general, more data allows greater detail of classification and information represented, with an acceptable degree of reliability.

NORTHERN ADMINISTRATION DISTRICT

The Corridor

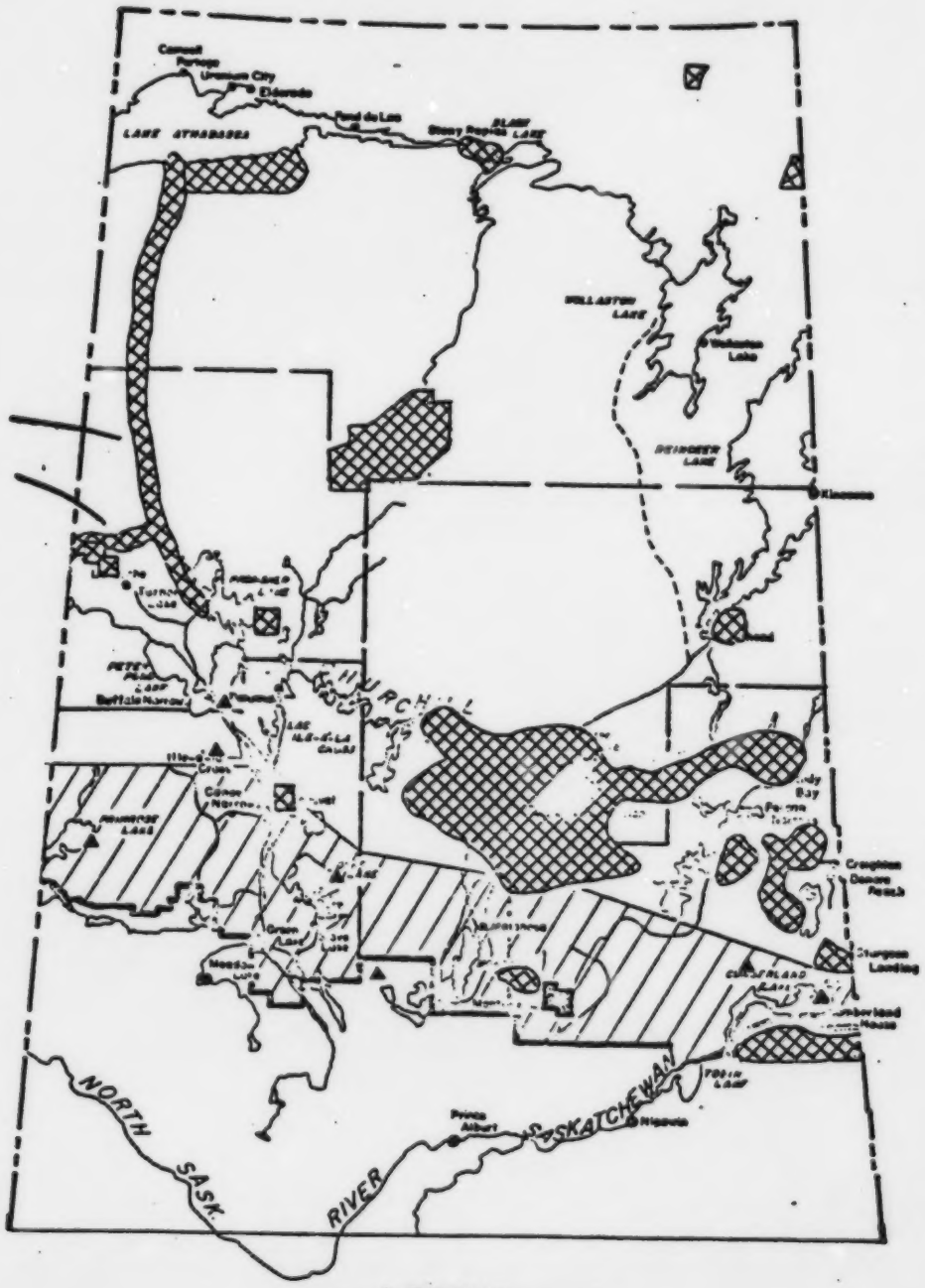

Figure 1.1

The acceptable degree of reliability can be defined by the degree of usefulness demanded for planning. The information presented is less useful if less reliable, for example, because it may not be accepted as a basis for compromise between competing uses and user groups. Thus, the most efficient, as well as most ethical, is to match the data base to the detail and complexity of the system. A system that is too detailed or complex for the data base will require many assumptions, and may be misleading, so the information is less usefully than a simpler system. As well, the better the system fits the form of the information, the more it is usually possible to display the information efficiently and clearly, reduce loss of detail.

Various purposes of planning make different demands on the detail of a system. For all but gross land use planning, the CLI maps are generally considered inadequate without site checking (Richards, 1973). Yet, the system has also been considered too detailed for classifying reconnaissance (overview, general) survey information. Overview systems are usually adequate for general policy making on land use. For actual planning, very detailed mapped information plus socioeconomic information, may be required. Thus, the data base used in a system is very important to its usefulness for planning purposes.

The scale of mapping reflects the level of detail to be mapped. An overview system, with a low level of detail, is most efficiently mapped in final form at small scale, although working maps may be larger scale. Scale and detail must be a good match: tiny areas on a map are difficult to read. Scale must also be chosen, however, according to the scale of other maps with which the series may be compared.

1.3 Types and Examples of Classification Systems

Classification of systems for planning of land use can be regarded in a hierarchy of complexity, as outlined by Dr. J. H. Richards (1977, University of Saskatchewan lecture):

(1) inherent characteristics (also known as biophysical classification, terrain analysis, or "mapping what is there";

(2) present land use and trends;

(3) use-capability;

(4) recommended use.

The first type of system organizes information on the biophysical characteristics of the landscape, representing geographical variation. This classification facilitates use of the information in the third and fourth systems, or directly for planning. The second system organizes a very important kind of socioeconomic information, and the only kind readily represented in map and text form. The third and fourth system types are, respectively, more complete planning tools. Pertinent examples of these types that are known to the author will be discussed, with data requirements

being considered, but not considered as a limitation initially, in order to indicate what further data gathering might be needed.

These systems will be discussed according to their usefulness for regional planning of northern Saskatchewan, and also for Cluff Lake Road Corridor and Clearwater River Valley study. The latter purpose differs from the former by dealing with a smaller, less self-contained area. The focus is on a smaller range of characteristics. More importantly, it should specifically consider and allow for the effect of greatly improved access on a narrow overland corridor, and on a river valley (itself another transportation route) which it crosses. The CLI system is typical in that consideration of access is specifically omitted, because access can be changed so quickly. Thus, a system chosen for the study may be somewhat less appropriate for planning elsewhere in northern Saskatchewan, except where a similar impact is involved.

1.3.1 Classification of Inherent Characteristics

Inherent characteristics are biophysical, and are most usefully classified with the characteristics of potential resources in mind. Classification must not be short-sighted, however, and thus major factors not presently considered important should be included: this calls for an ecological view, with factors of geology, soil, physiography, vegetation and climate integrated. This is also a logical basis for classes in a comprehensive system. Where basic data gathering has already been done, however, it has usually been organized by sectors, such as soils, and must be correlated for various interpretations. Where basic data gathering remains to be done, organization of information on an ecological or terrain basis is most logical and efficient.

Basic data gathering involves much time, effort and expense however, on a scale that has made governments, the only bodies equal to such a task, reluctant to undertake them. Such information is required still for most of the north. Satellite and air photo interpretation certainly aids a basic biophysical survey but without field checks on which to base interpretation, and to gather information not visible on satellite and air photos, it provides only very scanty data of the sort available on topographic maps (1:250,000 scale available for northern Saskatchewan). Field checks are especially expensive and time-consuming for northern Saskatchewan due to the remoteness of most of it.

The need for some kind of basic biophysical survey (and classification) was generally recognized after the CLI program began in the 1960's (Rees, 1977). Some of the various provincial agencies conducting mapping developed and utilized their own systems, as in British Columbia, described in *The Canada Land Inventory in Perspective*, (Rees, 1977). The latest such systems developed (see Thie and Ironside, 1976) follows the outline provided in *Guidelines for Biophysical Land Classification* (Lacate, 1969). It outlines a hierarchical system, with levels more detailed and mapped at a larger scale, incorporating relevant information for various extensive uses into terrain analysis. A pilot project by S. Zoltai (1968) for Manitoba and Saskatchewan was mentioned by these authors.

1.3.2 Present Land Use and Trends in Land Use Classification

The importance of documenting present land use and trends in it, which for the study area would be used by residents, must be emphasized. Also, assumptions should not be made about the importance of traditional land use to residents: the little that has been discovered about it in northern areas indicates that present opinion may be quite inaccurate. If a region is to develop, the people inhabiting that region should have first priority on the benefits to be gained from it. They and the region are vital to each other.

The transference of information from the land to a map is a fairly straightforward task, though time consuming, in agricultural and urban areas, and the main classification problem is allowing details to obscure the goals. For areas such as northern Saskatchewan, however, this process is much more difficult:

(1) secondary sources of data as found for agriculture or cities is scanty or unreliable for northern activities such as trapping, fishing, or even forestry (lack of geographical information);

(2) activities such as trapping, fishing or wilderness recreation as practised in northern Saskatchewan cause little alteration to the natural landscape, and thus do not show up on satellite and air photos.

This also makes it difficult to accurately map the data that are available.

Field work must then make up for lack of reliable or usable information from these sources, and this is expensive as already discussed. This field work involves interviews with local land users, and must be comprehensive, involving as many users as possible. Further human problems accompany the process of interviewing, especially with relatively isolated people of a different culture, as in northern Saskatchewan. Despite these difficulties, once again it is necessary for land use planning, because the present and future land use by local people, a valuable resource themselves, must be considered.

There are several systems that attempt to portray present land use. Trends in land use are also obtainable from interviews but are best described in the text. An example of a system is the *Environmental Atlas* by the Foothills (Yukon) Pipeline Ltd. in their application for a gas pipeline contract. This is a very simple system - too simple on which to base planning - but similar to what might be expected for the problem under consideration.

In the section on land use, trapping areas (in a narrow corridor along the route) are in four classes based on trapping intensity and quality. Fishing is classed as domestic or commercial. Beyond this, mines, parks, campgrounds, etc., are indicated. Habitat of some mammal and fish species are shown in separate sections. This system lacks any description of the home base or habits of users, the species utilized, possible trends in use, and ignores domestic consumptive use

other than fishing.

Another system is the Arctic Land Use Research (ALUR) program of the federal government for the Northwest Territories, the *Land Use Information Series* of maps. It provides information at an overview level on present land use (including wildlife habitats) plus some recreational potential, at 1:250,000 scale. In addition to fishing lodges, gas wells, etc., local hunting/trapping/fishing areas are delineated, settlement base of the users indicated, and kind of use very generally described, the latter information being provided in the legend. This information was gathered from scattered local interviews. Areas with seasonal habitat functions for various species (largely those of economic importance) are also outlined, as obtained from the Canadian Wildlife Service and other government agencies. This system is rather scanty in data, with no trends outlined, and no correlation of hunting, fishing, trapping to species.

Other systems that show these uses and others in greater detail have been developed, largely by aboriginal interest groups in land claims and development impact investigations. These include the *Inuit Land Use and Occupancy Project* System, the system developed to measure land use for Indian land claims in the James Bay project area, and the *Traditional Land Use Atlas of the Churchill and Reindeer Rivers* (1977).

The last was developed and used in northern Saskatchewan. The land use mapped with it was incomplete due to lack of 100% interview coverage, but served to indicate the nature of land use. Basically, good hunting and fishing grounds (by species), for both domestic and commercial uses, were outlined for each user interviewed, and combined. Some official trapping and hunting records were overlain to give some indication of the commercial productivity. The interviews also involved opinions on the proposed Wintego dam, and gave an overview of possible land use trends. This system is believed to be a step in the right direction for documenting present land use in northern Saskatchewan.

1.3.3 Use Capability Classification

Capability classification predicts the relative capability of areas of land to support a particular land use, involving both available resources, and drawbacks of impact due to use. The Canada Land Inventory is a multisector system, but there are other systems applicable to particular groups of uses, such as recreation, wildlife, and forestry. The CLI system itself was divided into such sectors, which were essentially separate.

The CLI system had agricultural, forestry, recreation and two wildlife land use capability sectors. They were ranked in seven classes of relative capability for use, based on limitations for use, except recreation that was based on attractiveness offset by durability of the landscape for recreational use. Thus, the recreational sector has additional problems of correlation, according to Rees (1977). Other problems arose because the sectors appeared deceptively correlatable: actually, "class 2" recreational potential is not of equivalent value to "class 2" forestry potential. For this kind of correlation, further socioeconomic data and judgement are required. The basic

measure in this kind of system is the relative value within a particular use.

The CLI was a first attempt, and subsequent systems have attempted to improve on it. Also, it is based on the thinking of the early 1960s on land use, and now is considered too narrow for many resource classification purposes. For instance, it based the values of the forest solely on its potential for saw timber, and the potential for wildlife on the production of game species for lucrative recreational hunting. The merits of the CLI system, modified CLI systems, and sector systems, will be discussed further in Subsection 1.4.

1.3.4 Recommended Use

Asking for a comprehensive land use plan is asking for classification of land parcels according to recommended use, but this transcends the level of use capability classification. Rational recommendations for use, however, must include consideration of inherent characteristics, present land use and trends in land use, use capability, and especially long-term socioeconomic forecasts of needs. Essentially, the last item involves a vision of what the long-term future, for a region and its country, can and should be. Despite attempts at computer processing and forecasting of rapidly changing socioeconomic conditions, this remains a matter of political/moral opinion.

Where the capability for a particular use is good, such land is not abundant, and the use is considered sufficiently important, recommendation of best use may be simple. Where this is true for more than one use, and development of each use would lead to conflict, however, the decision is difficult. Unfortunately, this does occur, as is likely for the Clearwater River Valley, which (without investigation) has good capability for wildlife, trapping/hunting/fishing, both intensive and wilderness recreation (which often have bitter one-way conflict), forestry and perhaps other uses.

Compromise is possible in some of these cases where conflict does not necessarily result in exclusion of a use: this is multiple land use that is feasible for the uses listed above, with careful planning and regulation. This is a problem, requiring innovation and new legislation. Intentions appear to be in this direction, however. Compromise is also possible by allowing for flexibility of the land between uses, over time. In some cases this is not possible: it is very difficult to revert industrial use to natural use, for example, and this may result in such political controversies as over the proposed Wintego dam on the Churchill River, in a similar area of northern Saskatchewan.

Improper recommendation of land use due to mechanical methods of decision making must be guarded against. The greatest danger is the exclusion of pertinent socioeconomic information and thoughtful predications. Picking the land use for a parcel of land that has the apparently highest classification (in a use capability system) is such a mechanical method: socioeconomic factors, both geographic (such as access) and those which affect the priorities of particular uses in the region, also must be considered.

The ultimate goal of this discussion is to decide what methods to use to arrive at a land use plan for northern Saskatchewan, however. Perhaps the best formula, then, is to attempt to present information clearly, organized and classified as far as possible while remaining objective, and then discussing and clearly defining the choices involved with limitations. The politicians will make the final choice.

1.4 Comparison of Use Capability Classifications by Sector

In the Canada Land Inventory, there are four capability-use sectors: agriculture, forestry, recreation and wildlife (subdivided into two, ungulates and waterfowl). The last three are the most important for northern Saskatchewan. No classification systems are known for mining, which seems to have different requirements in any case. Agriculture is important perhaps for domestic gardens, and this and other town site needs could be considered in a biophysical classification, but no town site capability classification is known either. Thus, the sectors to be discussed here are forestry, recreation and wildlife.

1.4.1 Forestry Sector Classification

In the CLI forestry capability classification, there are classes 1 to 7 (although British Columbia required additional classes 1a to 1e). The class are based on the potential mean annual increment for the most productive native species, which for Saskatchewan is usually white spruce. (Mean annual increment is the volume per unit area of land at rotation age divided by the rotation age). Limitations to productivity were noted for classes below 1. The system was designed to aid the identification of lands where intensive management practices associated with commercial forestry would be justified.

This class is inappropriate for northern Saskatchewan for more than one reason. The first is that intensive forest practices will not be appropriate for the forest harvesting industry in the foreseeable future, the expense not being justified by the large area and relatively low yield per unit area. Also, the system presents information only on potential wood volume production, and environmental limitations on that production. Today, other information on vegetation is required in judging land use capability and planning, such as nonforest vegetation valuable for other uses, site sensitivity to various kinds of disturbance, and other ecological site characteristics, important for choice of proper management techniques of harvesting and regeneration and for multiple use purposes.

Finally, as in the opinion of J. Benson (head of the Forest Inventory Maintenance Division of the Saskatchewan Department of Tourism and Renewable Resources, personal communication, 1977), the CLI classification would not provide reliable data without many years of testing the yield on various sites. This testing has not been done in Saskatchewan which is likely in the near future. Thus, if the classification was used here, it would provide unreliable, possibly misleading information. (All known methods of forest inventory presently used require field checking and the expert interpretation of satellite and air photos.)

Thus, a classification with consideration of other vegetation and ecological characteristics plus estimates of yield are necessary. Two are mentioned below. One is used by the Forest Management Institute, Canadian Forestry Service (*Vegetation Types of the MacKenzie Corridor*, 1974), which classifies forest cover by height, species and canopy density (actual cover at the time of survey), and also maps the entire area (forested and nonforested) by ecological types, related to permafrost and sensitivity to disturbance by construction or fire. Fourteen classes are mapped at 1:250,000 scale and seven complexes are mapped at 1:500,000 scale. This classification seems to have a good approach, but would require adaptation to conditions in northern Saskatchewan.

The other system is that of the Saskatchewan Forest Inventory Maintenance Division. Their inventory system has had many years of use and will be converted to a metric system on the next cycle of surveys for the commercial forest of Saskatchewan. (A more general survey project for the more northern forest began in 1977.) This map shows species, height, and canopy density, as in the first system mentioned. The temporary value of such a static system, which catches stands at all stages of maturity, has recently been improved on by the development and implementation of an ecological classification system (Kabzems, et al, 1976), which will take many years to cover the commercial belt, however.

This classification system is seems the most appropriate for the planning needs of northern Saskatchewan. Indeed, it would constitute part of the biophysical classification needed for use capability predication for wildlife and recreational use of the north. For forestry, it would provide a base for assessment of resources that would remain useful for long periods of time, allowing classification of possible wood yield, other uses, sensitivity to use, and recommended management practices.

1.4.2 Recreation Section Classification

Recreation is both difficult to define and difficult to map its land use capability, largely because it involves aesthetic enjoyment, a highly subjective matter, and also includes a very wide range of activities (some of which remain to be discovered). This makes it difficult to measure the value of land for recreation in general. The Canada Land Inventory classified land according to its estimated potential to attract and sustain numbers of recreationists, engaged in the activities for which the land was considered best suited, higher class land being that could "attract and sustain" more recreationists.

The definition "attract and sustain" contains two separate concepts that are difficult to reconcile. The first is based on attractions, things that people will come to enjoy. The second is based on the fragility of that attraction under the stress of being enjoyed. In addition, classification, by numbers of recreationists, biases the results. In Saskatchewan, a higher value is placed on intensive recreational use than on extensive, "wilderness" use. Since the natural attractiveness and physical fragility of northern Saskatchewan environments suits it more for the second class of use, the CLI system is inappropriate.

One also might argue that the basic premise of the CLI system, based on man-days of use attracted and sustained, makes it inappropriate for classification of lands for recreation. Is it the length of time spent in seeking recreation, or is it the quality of the resource to evoke appreciation, allowing a person to "recreate" his appreciation of life, that is more important? If one chooses the latter, again the practical problem is measurement of the quality of the resource for subjective recreation.

If this matter is considered sufficiently important, and for "wilderness" recreation, some measure may be possible. The basis for this is scenery, the one quality for which appreciation seems fairly standard among individuals, and among recreational uses. As R. Lucas (1962) found in a study of recreational land use, at least half the reason recreationists visited particular fishing lodges was the scenery. This factor is not even mentioned in advertising. Attractiveness of a typical scenery type can be fairly reliably evaluated, at least within a culture.

Beaubier and Pierce (1974) outlined a method for numerically evaluating scenery (within areas with a fairly standard pattern), for the *Land Use Information Series* for the Northwest Territories. It was modelled after other methods they had investigated, which based evaluation on a 40:35:25 point ratio for land, water, and vegetation, respectively. It was adapted to regional scenic characteristics and could likely be well adapted to northern Saskatchewan.

In addition to this basic classification, the series include CLI-type evaluation of particular sites (attractions), where they could be verified. This system was admitted to be an overview type, but field checks were still required. It seems more possible to adapt this system to northern Saskatchewan rather than the CLI system. The details could be added for sites (perhaps in less processed form for greater flexibility of interpretation, such as the quota for sport fish for a particular lake). This method is more appropriate to the northern situation.

Another system was mentioned in Rees' (1977) critique of the CLI program, and doubtless there are others. The system was developed in British Columbia for planning use. It consists of two separate potential resource inventories, which presumably must be compared for interpretation:

(1) a features (attractions) inventory, identifying type and quality;

(2) a physical carrying capacity inventory.

This separates the capabilities to "attract" and "sustain." The simple system recommended above would be improved by similar inclusion of physical carrying capacity classification.

One final matter requires discussion with recreation capability classification. It concerns the significance of tracts of land for recreational use: the Ontario recreation land inventory (Cressman, 1971) classifies significance by the attraction's ability to attract recreationists locally, regionally, provincially, or nationally. There is no objective method of evaluating this important quality. Areas of potential use conflict was the subject of much controversy in the Churchill

River basin and perhaps the Clearwater River valley, (or the Athabasca sand dunes) because it affects the importance of recreation relative to other uses, and implies that the most significant areas must be protected from unregulated use. This measure is beyond the capacity of a use capability classification, but should be mentioned in the discussion of the alternate choices for land use in the area.

1.4.3 Wildlife Sector Systems

The first problem is to define use capability of land for wildlife. The wildlife itself is the potential resource, and in the CLI system, use capability is defined as the capability of the land to produce certain species. This is due to the orientation of the CLI system towards wildlife valued for the lucrative practise of recreational hunting: it covered only ungulate and waterfowl species.

Other wildlife values are considered important as well, however, especially in northern Saskatchewan. Wildlife is equally important for commercial trapping and fishing, and domestic hunting and fishing by resident, for many rare species valued (ecological and aesthetic reasons), for which northern Saskatchewan provided wilderness habitat. Thus, a new definition is needed which includes these values.

Ideally, a system could be developed for evaluating habitat for its capability to produce (sustain) various species, based on a biophysical classification. Such a system is not known to the authors; however, the *Land Use Information Series* employs more of an overview system, but still based on habitat quality. LUIS includes species types valuable in northern Saskatchewan. LUIS consists of delineation of areas judged to be important as particular often seasonal) habitat for particular species or species groups, and notes critical areas (the destruction of which would endanger the species in the region). Even this overview system requires a great deal of field work however.

1.5 Summary

1.5.1 The Canada Land Inventory

The Canada Land Inventory is the most obvious system to be considered for resource inventory and land use classification, having been used in a nationwide effort, and covering most nonurban sectors. The authors does not consider this system appropriate for northern Saskatchewan, however. It is oriented towards the planning needs of southern Canada, which has very different physical and socioeconomic characteristics and thus requires different emphasis on kinds of land uses, and classification of more intensive kinds of uses. There are criticisms of the CLI system, but this orientation is the main reason that it is not recommended for use in northern Saskatchewan.

1.5.2 Summary of Recommendations of Systems

Classification systems were considered for northern Saskatchewan in the classes of:

(1) inherent characteristics classification;

(2) present land use and trends in land use classification systems;

(3) use capability (or resource inventory and land use capability) systems.

The third class was further considered for forestry, recreation and wildlife sectors.

A survey of inherent or biophysical characteristics is considered necessary for any kind of fairly comprehensive use capability classification for northern Saskatchewan, but it would be a major effort for which there are no plans at present. Only the general outline provided by *Guidelines for Biophysical Land Classification* (Lacate, 1969) was discussed, which emerge as appropriate for northern Saskatchewan. It includes a hierarchy of level of detail according to the scale of photos and mapping, and a field check and other information available.

Collection and classification of information on present land use and trends in land use is necessary for regional planning. Systems well known by the author are those for land use by local people, such as those in the *Environmental Atlas* (1977). The first is very simple (not a fault in itself), but it presents information on trapping intensity and quality in rigid form and with questionable reliability, and leaves out other needed information. The second system is a slight improvement, being more flexible for interpretation, presenting slighting more information, and with reliability easier to judge. The third system is considered most appropriate and comprehensive, having been developed in northern Saskatchewan. But, it requires refinement and much field work.

For the forestry sector of use capability classifications, the CLI, Forest Management Institute, and Saskatchewan Forest Inventory Maintenance Division systems were discussed. The first was considered narrow and inappropriate based for northern Saskatchewan, as well as requiring information not available and difficult to collect at present, thus limiting reliability. The other two were considered more appropriate, having included classification of non-forest vegetation, and classification by ecological type and sensitivity to disturbance. The third system was designed for the "commercial" forest belt of Saskatchewan, and so may be the most appropriate.

For recreation use capability, the CLI Maps, and a system developed in British Columbia (mentioned by Rees, 1977), were discussed. The CLI system was judged inappropriate once more because of its southern, intensive recreational use orientation, and because of its insistence on attempting to measure essentially unquantifiable characteristics. The second system is a less detailed, overview type, but is considered more appropriate for northern Saskatchewan because of its emphasis on wilderness scenery. It has flexibility to include ratings of potential for

particular sites. The British Columbia system includes a possible improvement, an inventory of the physical capability (durability) of the landscape for recreational use.

Systems discussed for classification of use capability for wildlife were the CLI, and the *Land Use Information Series* maps systems. The CLI system is considered inappropriate for northern Saskatchewan because of its southern and commercial orientation. An ideal system would be one which classified habitat on a biophysical basis, oriented to species important at present but also allowing some interpretation of capability for other species as well. The *Land Use Information Series* system is similar, but at an overview level of detail. It utilizes Canadian Wildlife Service data for the Northwest Territories, of which an equivalent seems unavailable for northern Saskatchewan. Even at this level of detail, much field work would be required.

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2.0 PRESENT POSSIBILITIES

The systems recommended are those which would be best for planning use in northern Saskatchewan, if there were no data limitations. Without the required field work on this present project, the level of detail cannot be presented with fair reliability. The main known data sources are large-scale air photos and forest inventory maps for the lower Clearwater River valley, satellite and air photos of various scales for the narrow strip of the road corridor (from the highway study), satellite imagery, a small amount of present land use field work, and other scattered sources.

For this study, it is recommended that high priority be given to interpreting and classifying the data available on present land use and trends in land use. Problems of conflict between use by residents and outsiders are nearly certain to become acute in northern Saskatchewan in the near future, if the land use and rights of the residents are ignored.

Because surveys for the purpose of providing data for specific classification systems have not been carried out, however, the systems must be modified to fit the available data. This is somewhat beyond the scope of this contract, but some suggestions can be made.

2.1 Scale

The scale that was suggested for the study was 1:250,000, or another suitably and commonly used scale. Some detail would probably be lost at this small scale, but it is a large jump to the next commonly used scale, 1:50,000 (National Topographic Series). For most maps that could be produced, using this larger scale would be inefficient. Therefore, all maps should probably be produced at 1:250,000, with those for which more detail is both important and possible also produced at 1:50,000.

2.2 Modified Systems and Methodology

2.2.1 Present Lane Use and Trends in Lane Use

If there is enough data on present land use for it to be worthwhile mapping, the *Land Use Information Series* system would be the best model to follow with modification from *Environmental Atlas* (Foothills). It is designed so that more data could readily be added. From interviews, it may be worthwhile to outline hunting areas of various groups, and it should be possible to indicate numbers of trappers and commercial fishermen. It would be desirable to add details of species sought, season, the utilization made of them, and the importance of the activity to the group, on the map or in the text (description in the legend).

A similar treatment could be given to hunting and fishing lodges. This information may be obtained from interviews, from the Department of Northern Saskatchewan trapping and commercial fishing records, from government conservation officers working in the area, and

perhaps some from other provincial departments. There is also some recreational use of the area at present, but presumably this is integrated with hunting/fishing/trapping activities both for residents and nonresidents. Some understanding of this might accompany the interviews, especially for the lodges and outfitters camps. This could be included in the description in the map legend. The legends for trapping and hunting are given in Figure 2.1 and the fishing resources in Figure 2.2.

2.2.2 Forestry

The Forest Inventory Maintenance Division is planning to map the northern Saskatchewan Forest by classes of softwood, hardwood or mixed wood, and young or mature (according to height), at a scale of 1:50,000. This system seems to fit the data that will be obtainable for this study. Small (less than one-half mile square) areas will not be mappable at 1:250,000 (4 miles:1 inch), which might limit its usefulness for determining the feasibility of small local projects (see Intergroup, 1976), but which suits the data available. Regular forest inventory maps are available for the lower Clearwater at 1:15,840 scale (4 inches:1 mile).

Ecological classification will not be possible without field work, but some landscape analysis should be, with such classes as rock exposure, sand, muskeg, marsh, open water, and with treed and non-treed designation where the forest cover is not classified. Most important would be the delineation of areas of environmental sensitivity, such as permafrost areas, or areas of erodible sand. Some field checks may be sufficient to outline and integrate this information with the landscape analysis. The modified legend is given in Figure 2.3.

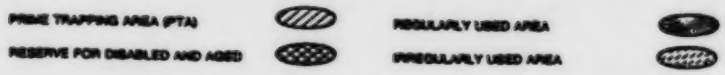
2.2.3 Wildlife Classification

The Lake Use Information Series system for representing wildlife habitat would be the best model to follow, with the information that is presently available. Some habitat analysis may be possible where there are satellite and air photos, especially for the lower Clearwater. Without field work, habitat designation would be only tentative, however. The Saskatchewan Department of Natural Resources has information on habitat types for various species, as well as their range of distribution in northern Saskatchewan, which would aid such analysis. This, plus later work in the study, could aid in the identification of areas where it is most important to conduct field work for more data on wildlife. The legend is given in Figure 2.4a and Figure 2.4b.

2.2.4 Recreation

Again, the *Land Use Information Series* system is the one that can be best modified to fit the data obtainable for recreational use potential. Scenic analysis should be possible for the lower Clearwater and perhaps for representative areas along the road corridor, where there are satellite and air photos available. Parks Canada has conducted surveys along the Clearwater. Data on particular sites with qualities worth noting, such as campsites, unique scenery, or

TRAPPING SERIES



HUNTING AND TRAPPING

HUNTING, TRAPPING AND FISHING CONTINUE TO PLAY AN IMPORTANT ROLE IN THE LIFESTYLE OF MANY NATIVE PEOPLE AND OFTEN THESE ACTIVITIES ARE PURSUED YEAR ROUND. THE AREAS FREQUENTED ARE DETERMINED LARGELY BY SEASONAL MOVEMENTS OF FISH AND GAME, AND OFTEN ONE ACTIVITY COMPLIMENTS ANOTHER, DEPENDING ON THE SEASON. PEOPLE WHO ONCE WERE NOMADIC ARE NOW ESTABLISHED AS PERMANENT RESIDENTS IN VILLAGES. HOWEVER MANY STILL REGULARLY VISIT PARTS OF THE REGION TO HUNT, FISH AND TRAP. IN RECENT TIMES THE LEVEL OF ACTIVITY HAS VARIED WIDELY BECAUSE OF THE FLUCTUATION OF PRICES AND SUBSIDIES, AVAILABILITY OF WAGE EMPLOYMENT AND TRANSPORTATION RESULTING FROM CENTRALIZATION. HOWEVER THERE IS RENEWED INTEREST BUT THE DEGREE OF ACTIVITY IS DIFFICULT TO PREDICT FROM YEAR TO YEAR. THUS THE LINES ON THE MAP ARE SELDOM REPRESENTING THE EXACT LIMITS OF HUNTING AND FISHING AND TRAPPING. PATTERNS OF LAND USE ARE CONSTANTLY CHANGING AND THE BOUNDARIES ON THE MAP SHOULD BE CONSIDERED AS BEING GENERALIZED. THEREFORE BEFORE ANY LAND USE ACTIVITIES ARE PLANNED USING THE MAP THE LOCAL TRAPPING ASSOCIATION SHOULD BE CONTACTED TO AVOID POSSIBLE RESOURCE-USE CONFLICTS

1. Prime Trapping Areas: Used extensively during winter and spring.
2. Regularly Used Areas: Used on a regular, but not intensive basis during winter and spring.
3. Irregularly Used Areas: Used lightly or only during specific times of the trapping season or to trap specific animals.

TRAPPER'S CABIN • LOCATION

TRAPPER'S TENT OR CAMP ✲ LOCATION

AREA OF TRAPLINE UNKNOWN

1 IDENTIFICATION #

L LAC LA LOCHE T TURNOR LAKE

FIGURE 2.1 HUNTING AND TRAPPING MAPPING LEGEND
FOOTHILL PIPELINE LTD (LUIS)

FISH RESOURCES AND FISHING

NOTE: FISHERIES INFORMATION IS PRELIMINARY AND INCOMPLETE

SYMBOLS

(M1)	FISH MIGRATION ROUTE
(S1)	EXISTING OR POTENTIAL FISH SPAWNING AREA
(C1)	COMMERCIAL FISHING
(D1)	IMPORTANT AREAS FOR DOMESTIC FISHING
(1)	COMMENTS BY #

EXAMPLES OF FISH RESOURCES AND FISHING:

M1	THE CLEARWATER RIVER IS A 6TH ORDER STREAM WHICH IS USED AS A MIGRATION ROUTE FOR SPAWNING WALLEYE, NORTHERN PIKE, AND ARCTIC GRAYLING.
S1	THE CLEARWATER RIVER HAS THE POTENTIAL FOR SPAWNING WALLEYE, NORTHERN PIKE, ARCTIC GRAYLING, LAKE TROUT, & LAKE WHITEFISH.
C1	WASEKAMIO LAKE IS USED AS A COMMERCIAL FISHING LAKE FOR WHITEFISH, NORTHERN PIKE AND WALLEYE.
D1	THE MACLEAN RIVER IS A 5TH ORDER AND IS FISHED YEAR ROUND.

FIGURE 2.2 FISH RESOURCES AND FISHING MAPPING LEGEND
(SOURCE: LAND USE INFORMATION SERIES- ALUR PROGRAM)

FOREST REFERENCE

TYPE

Softwood above 30'	S	below 30'	S
Hardwood above 30'	H	below 30'	H
Mixedwood (softwood dom.)	SH	below 30'	SH
Mixedwood (hardwood dom.)	HS	below 30'	HS

CROWN COVER

10% to 30%	A
30% to 50%	B
50% to 70%	C
70% to 100%	D

HEIGHT

Up to 30'	1
30' to 50'	2
50' to 70'	3
Over 70'	4

SPECIES

Trembling Aspen (White Poplar)	tA	White Spruce	wS
Balsam Poplar (Black Poplar)	bPo	Black Spruce	bS
White Birch	wB	Balsam Fir	bF
Tamarack	tL	Jack Pine	jP

Each forest sub-division is denoted by letters and a numeral, showing respectively the type, crown cover and height.

Marsh, bog, open muskeg		Treed muskeg	
Recent clear cut (last 10 yrs.)		Brushland	
Hay Meadow		Recent burn (last 10 yrs.)	B.O.
Recent partial cut (last 20 yrs.)		Non-forested land	
Flooded land			

SOURCE: DTRR

LEGENDS

LAND USE and SPECIAL AREAS

SOURCE: FOOTHILLS PIPELINES LTD

FIGURE 2.3 FORESTRY AND HUMAN ACTIVITY MAPPING LEGEND
(AFTER FOOTHILLS PIPELINES LTD)

WILDLIFE LEGEND

SYMBOLS

1Wbs	IMPORTANT WILDLIFE AREAS
*1Wbs	CRITICAL WILDLIFE AREA
------	BOUNDARY OF ZONE
———	BOUNDARY OF TRAPPING AREA
1S	OWNER OF TRAPPING OR HUNTING LEASE
- - - -	GAME MANAGEMENT #
	BOUNDARY OF OUTFITTER
	PRINCIPAL ZONE OF OUTFITTER
*	LOCATION OF OUTFITTER
M1	FISH MIGRATION ROUTE
S1	EXISTING OR POTENTIAL FISH SPAWING AREA
C1	COMMERCIAL FISHING
D1	DOMESTIC FISHING
68	BOUNDARY AND NUMBER OF IBP RESERVE SITE
A1	ARCHEOLOGICAL SITE
H1	HISTORICAL SITE

CODE	BOUNDARY	SPECIES
AF	———	ARCTIC FOX
AN	———	AREA OF NOTE
B	—o—	BARREN GROUND CARIBOU
BB	—n—	BLACK BEAR
C	—●—	WOODLAND CARIBOU
CF	———	RED(COLOURED) FOX
D	—■—	DEER(M-MULE/W-WHITETAIL)
G	—△—	GRIZZLY BEAR
LX	———	LYNX
M	———	MUSKRAT
MK	———	MINK
MS	—▲—	MOOSE
O	———	OTTER
RE	—▲—	RARE OR ENDANGERED SPECIES
T	—n—	MARTIN
V	—X—	BEAVER
W	—■—	WATERFOWL
WF	———	WOLF
WV	———	WOLVERINE

HABITAT FUNCTION

b	BREEDING AREA
d	DENNING AREA
l	STAGING AREA
m	MIGRATORY ROUTE
n	CALVING OR NESTING AREA
r	RANGE
t	ALL HABITAT FUNCTIONS

SEASONAL UTILIZATION

s	SPRING OR SUMMER
w	FALL OR WINTER
y	ALL YEAR ROUND

OTHER

MIGRATION ROUTE

EXPLANATION OF SYMBOL

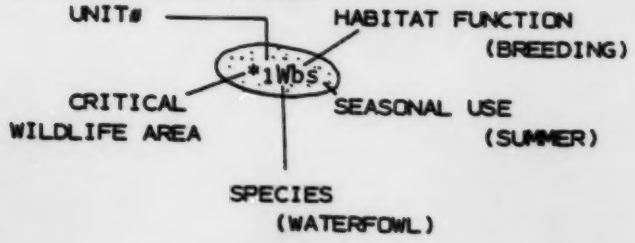


FIGURE 2.4A WILDLIFE LEGEND - ANIMALS

(SOURCE: LAND USE INFORMATION SERIES-ALUR PROGRAM)

BIRDS

WATERFOWL MIGRATION/STAGING AREAS	W-M/S	EAGLE NEST	E-TN
WATERFOWL BREEDING AREA	W-B	RAPTER: TREE-NESTING SPECIES BREEDING AREA	R-TN
POSSIBLE RARE AND/OR ENDANGERED SPECIES BREEDING AREA	W-R	RAPTER: CLIFF-NESTING BREEDING AREA	R-CN
POTENTIAL	P	POTENTIAL	P
UPLAND GAME BIRD RANGE	UG	MIGRATION PATHWAYS (SWANS & GEESE)	⟷

FIGURE 2.4B WILDLIFE LEGEND - BIRDS
SOURCE: FOOTHILLS PIPELINES LTD

good sport fishing, could be obtained from these sources and from the Department of Northern Saskatchewan records, and mapped using the CLI recreation classification system (see Figure 2.5a). In addition, a classification was found for aesthetics and archaeology (Figure 2.5b).

It is recommended, for the lower Clearwater River valley at least, that tentative zones be delineated:

(1) strips of forest along the river to be left uncut;

(2) areas to be left totally undisturbed, perhaps in critical habitat areas for rare wildlife, or important archaeological sites;

(3) campsites, so that camping is regulated.

An additional source for this could be the forest inventory maps. This tentative zoning also may indicate where field work should be carried out.

2.3 Conclusions

The *Land Use Information Series*, developed for the northern territories, is the best model for use in northern Saskatchewan. A forest inventory system may be added, and present land use should be emphasized. This system is at an overview level of detail, all that is possible with the data obtainable. This limitation also indicates that it should be a resource inventory rather than a land use capability classification system. The aim is that it will consolidate present data and knowledge, and provide a basis for general planning and further study.

RECREATION AND TOURISM

EXPLANATION OF SITE SYMBOLS

SITE LOCATION / SITE CLASS

■ OR ▬ / 2FR

2FR: RECREATIONAL CAPABILITIES OF SITES (ARRANGES IN DESCENDING ORDER)

SITE CLASSES

CLASS 1	VERY HIGH CAPABILITY FOR OUTDOOR
CLASS 2	HIGH CAPABILITY FOR OUTDOOR RECREATION
CLASS 3	MODERATELY HIGH CAPABILITY
CLASS 4	MODERATE CAPABILITY

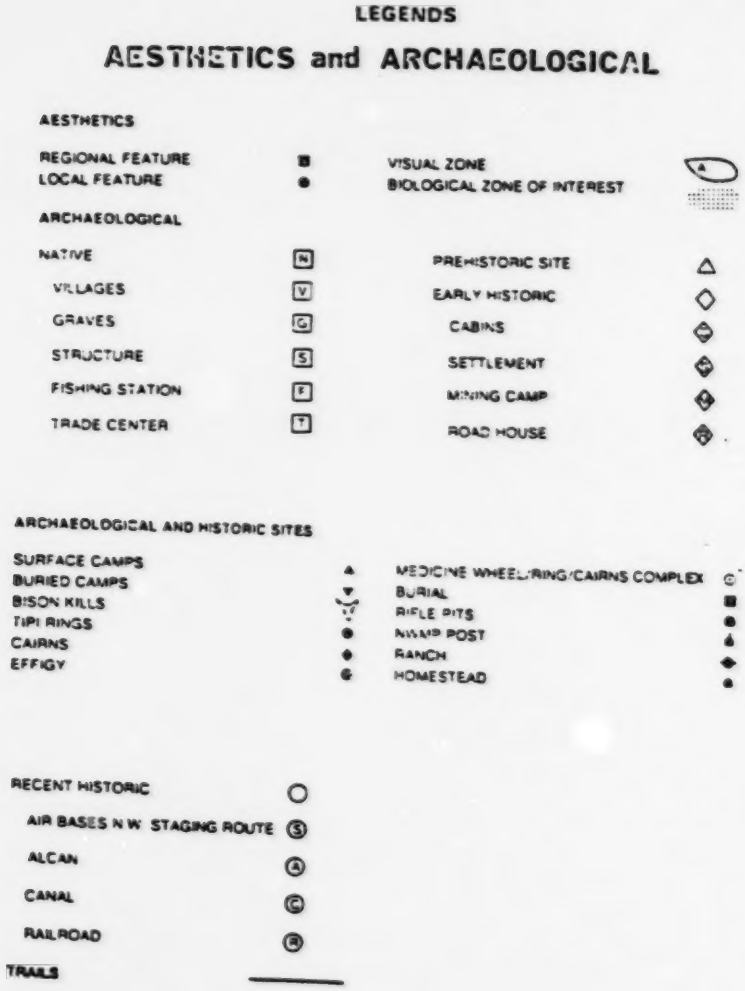
RECREATIONAL CAPABILITY OF SITES

B	FAMILY BEACH	N	COTTAGING(LODGES & CAMPS)
F	FALLS OR RAPIDS	R	GEOLOGICAL INTEREST
J	GATHERING OR COLLECTING	V	VIEWING (CLASS 1 & 2 ONLY)
K	CAMPING	Z	MAN-MADE FEATURES
L	LANDFORM FEATURES (UN-CONSOLIDATED MATERIAL)		

AREAS, ROUTES, POINTS OF INTEREST OR FACILITIES

R1	AREA. ROUTE OR POINT OF INTEREST	*	LOCATION OF SPORT FISHING CAMP
△	CAMPGROUND, ROADSIDE PARK OR PICNIC SITE	⊠	PROPOSED CAMPGROUND

FIGURE 2.5A RECREATION AND HISTORIC SITES



AESTHETICS

BACKGROUND

The accompanying maps illustrate an evaluation of visual resources.

Visual Features: Site specific landscape elements of visual interest that are geological, hydrological, biological or cultural in origin. Features of large scale that serve as landmarks are designated as "regional features." High quality, smaller scale points of interest are shown as "local features." "Biological Zones of Interest" are areas of game sanctuaries or International Biological Program (IBP) sites that would have wildlife and vegetational interest and diversity.

Visual Zones: The corridor along the proposed pipeline alignment was divided into zones with common visual characteristics such a vegetation, landform, water form and the presence of landmark features.

ARCHAEOLOGY

BACKGROUND

The following maps depict archaeological and historical sites within the corridor.

Saskatchewan site locations were also obtained from this source and from consultation of the Saskatchewan Museum of Natural History site files. Some sites, in the Saskatchewan Section, were also recorded during aerial reconnaissance.

Log cabin locations are based on observations made during aerial reconnaissance. They are not in all instances precise.

Saskatchewan historic site locations are from Turner (1950) and Tie (1974). They are not precise.

ENVIRONMENTAL ATLAS
FOOTHILLS PIPE LINES (YUKON) LTD.

Figure 2.5b Aesthetics and Archaeology Mapping Legend

3.0 GUIDELINES FOR DEVELOPMENT

The key to effective management of the resources of Northern Saskatchewan (and tested on the Western Side) should be an integrated management planning conducted under a comprehensive, interagency approach. The provincial departments involved are DNS, DOH, SEM, and SNR (and CAMECO). Based on the regional zoning priorities and guidelines, these plans will allocate land uses for specific portions of the management area. During the planning process, the needs for possible changes in zone boundaries should be identified.

The regional land use zoning is based on the best existing knowledge. Following implementation, it should be subject to continuous monitoring and the review of more detailed evaluations and resource or land use information. A new plan should be developed every five years with the review to start in the third year.

This process will include examination of the following:

(1) Review and approval of integrated management plans;
(2) Resource management guidelines;
(3) Revisions to regional zoning;
(4) Disposition policies and procedures;
(5) Development review procedures;
(6) Information programs to inform the public of the resources and problems of the West Side and the approach of the Government to management of the area.

Adoption of the regional zoning system and the interagency planning (DNS, DOH, SEM, SNR and CAMECO) and administrative approach will provide a flexible, positive and orderly direction for the use and development of the valuable public resources of the West Side.

The regional land use zoning system for resource management consists of three broad land use zones. These three zones designate the large areas of land for varying degrees of protection, multiple use management or resource development.

3.1 Classification Systems Used for Planning

3.1.1 Regional Land Use Zoning System

The land use zoning system embodied in this report applies at the regional level only. It can be employed as a means of translating Government resource policies into a planning or decision making format. It identifies broad units of land for which policies and integrated management objectives are specified. These include an indication of the types of uses that can be permitted. The zones provide for the resolution of land use conflicts; however, the primary purpose is to allocate resources on a regional scale. Detailed management plans can be prepared for selected areas on a priority basis.

The land use priorities identified by the zoning should be based on a combined evaluation of the physical environment, the existing resources, present land use, demand and public interest.

The zoning allows for the appropriate utilization of the diverse resource base. It directs integrated land management efforts toward maximizing the benefits derived from the region while minimizing the resource conflicts and costs incurred.

Regional zoning provides the background for detailed resource management planning. It does not allocate land to specific projects within a zone. It provides flexibility for making decisions on specific project proposals within a zone in accord with the range of permitted uses. The system recognizes there are existing commitments and ongoing land use and resource development activities within most of the zones.

Environmental and management control mechanisms operating under existing legislation should be ensuring a high standard of resource management and control. The zoning does not intend to replace or impinge upon these, but rather to give positive direction for future management and to identify permitted and restricted uses within these zones.

The land use zones are:

(1) Protection
(2) Resource Management
(3) Development

Within the broad zones, eight detailed land use zones outline a range of permitted activities, in keeping with the priorities and management objectives of the zone. The eight land use zones are:

(1)	Protection	(a)	Prime protection
		(b)	Critical wildlife
(2)	Resource Management	(c)	Special use
		(d)	General recreation
		(e)	Multiple use
		(f)	Agriculture
(3)	Development	(g)	Industrial
		(h)	Facility

These eight land use zones are described in the following text and are displayed on the three zoning maps enclosed. The activities permitted in each zone are summarized in the Table of Permitted Activities (Table 3.1).

Table 3.1 - Table of Permitted Activities by Land Use Zones

Zone / Activity	1 Prime Protection	2 Critical Wildlife	3 Special Use	4 General Recreation	5 Multiple Use	6 Agriculture	7 Industrial	8 Facility
Nonmecanical Recreation	/	/	R	/	/	/	R	/
Fishing	/	/	R	/	/	/	R	/
Hunting	/	/	/	/	/	/	R	X
Trails (nonmotorized)	R	R	R	/	/	/	R	/
Off Highway Vehicle Activity	X	R	R	R	/	/	/	/
Primitive Camping	R	R	R	/	/	/	X	X
Serviced Camping	X	X	R	/	/	R	X	/
Intensive Recreation	R	X	R	/	/	X	X	/
Scientific Study	/	R	R	R	/	/	/	/
Trapping	/	R	R	R	/	/	X	X
Logging	X	R	R	R	/	/	/	X
Cultivation	X	X	R	X	R	/	X	R
Domestic Grazing	X	R	R	X	/	/	X	R
Exploration and Development	X	R	R	X	/	/	/	R
Mineral Exploration and Development	X	X	R	X	/	/	/	X
Transportation and Utility Corridors	R	R	R	R	/	/	/	/
Commercial Development	X	X	R	R	R	R	X	/
Industrial Development	X	X	R	X	/	R	/	R
Residential	X	X	R	X	R	/	R	/

/ Permitted Uses - Uses that will be allowed under normal guidelines and land use regulations.
X Not Permitted - Uses that are not compatible with the intent or capabilities of a land use zone.
R Restricted - Uses that may be compatible under certain circumstances and stricter than normal controls.

(a) Prime Protection Zone

The intent of the Prime Protection Zone is to preserve the environmentally sensitive terrain and the valuable aesthetic resource. As in all zones, watershed protection will be a paramount concern, along with the preservation of rare or fragile biologic communities and representative areas of natural landscape.

Land use will be strongly oriented toward dispersed "back country" recreation activities such as hiking, fishing, hunting and other nonmechanized forms of recreation. Scientific study and research projects not requiring land dispositions will be allowed under normal conditions of environmental protection. No serviced camping facilities will be permitted, and primitive camping will be on a restricted basis, due to the needs for careful control of use levels at specific sites. Commercial development and transportation and utility systems will normally be precluded; however, certain exceptions may have to be recognized.

Also, future major roads or utility corridors may, of necessity, require access through the zone. Restricted activities will require particularly stringent environmental conditions and resource management controls.

Land use activities that will not be permitted include mineral exploration and development, petroleum and natural gas exploration and development, commercial timber operations, industrial development, residential development and off-highway vehicle activities.

Where considered essential, management programs may include fire control, wildlife habitat improvement and sanitation (disease control) cutting. Wildlife habitat improvement will generally be by means of controlled burning or fertilization programs rather than aesthetically unattractive mechanical means. Fire control and sanitation cutting will be permitted where there is a proven hazard to merchantable timber outside of the zone.

Where lands in the zone are presently being utilized for resource development activities, the uses will be continued until the extraction is complete, after which the lands will be reclaimed and allowed to return to a near-natural state. All other conflicting uses will be phased out by the responsible management agency as soon as possible after the zone is established.

(b) Critical Wildlife Zone

The Clearwater River valley is a unique and important wildlife region, due to the many combinations of climate, topography and vegetation that provide suitable habitat for a wide variety of species.

Both the hunting and nonhunting public gain considerable recreational benefits from the wildlife resources. Hunting and trapping are important in the area and the outfitting industries depend to a great extent on the wildlife ranges and populations of the region.

The Critical Wildlife Zone consists of ranges or habitats such as key winter range, migration routes and calving areas that are essential to the survival of specific wildlife populations. Lands in the zone include only those habitat areas that are permanent in nature due to climate or topography. Since most of the large animal species are highly migratory, they are of course not confined to these relatively small areas. Wildlife values must be recognized at the management planning level for the entire area. Dispositions and land uses within the Critical Wildlife Zone must be compatible with wildlife management objectives.

Wildlife management practices may include habitat improvement and, in some instanced, this may be coordinated with timber harvesting. Compatible uses will include dispersed recreation, limited timber harvesting, and restricted petroleum and natural gas exploration and development. Trapping will continue in areas presently used for this purpose; however, carrying capacities will be carefully controlled to be compatible with wildlife values. Utility and transportation corridors will be considered only in special circumstances if other alternatives are not available.

Uses not permitted include off-highway vehicles, serviced camping and intensive recreation, cultivation, mineral exploration and development, commercial development and industrial and residential development.

(c) Special Use Zone

The Special Use Zone contains lands that have unique management requirements or legislative status that cannot be accommodated within any of the other zones. Each area will have its own management conditions and, for this reason, the activities listed in the Table of Permitted Activities are all shown as being restricted.

Examples of this zone include research areas, Indian Reserves and designated heritage sites.

(d) General Recreation Zone

Lands required to ensure the retention for natural purposes is defined by this zone. The intent of the zone is to provide a wide range of dispersed and concentrated outdoor activities in a natural setting. This zone serves as a focal point for the broad range of recreation activities. Off-highway vehicle use will be confined to designated trails. Hunting and the use of fire arms will be allowed only on a carefully controlled basis under certain circumstances. Transportation and utility corridor development will also

be limited. Although, generally, the zone will be adjacent to, or bisected by, key access roads.

Management emphasis will be on maintenance of the natural environment. Resources may be managed or manipulated to sustain or to improve vistas; stream habitat may be improved to increase sport fishing opportunities.

The General Recreation Zone will not permit cultivation, domestic grazing, petroleum and natural gas or mineral exploration and development, industrial development or residential development.

(e) Multiple Use Zone

The Multiple Use Zone contains the broad areas that comprise a major portion of the regional development. The zone contains a variety of natural resources: water timber, scenic areas and forage. Much of the area will be accessible to public and industrial use, and the zone should experience growing pressures for public land dispositions and resource development.

The primary goal of this zone is to allow the utilization of the full range of available resources within a multiple use contact without adversely affecting watershed or environmental conditions in the long term. The allocation of permitted uses to specific land areas will be based upon land capability and the integrated management planning process within the framework of existing regulations and control procedures. Relatively small areas of land in the zone will be disturbed by resource development at any one time.

Mineral exploration and development, will be permitted in this zone consistent with existing policy, regulations and environmental protection standards.

Numerous recreation pursuits, including sightseeing, pleasure driving, outfitting, hiking, fishing, hunting, cross-country skiing and overnight camping will be permitted in this zone. Much of the angling will take place in the Multiple Use Zone. Land practices in this and the other zones will require careful controls in order to protect this recreational resource by means of maintaining water quality and stream condition.

The identification of areas for off-highway vehicle use will be a priority consideration in this zone. Efforts will be made to confine necessary transportation and utility corridors to the Multiple Use Zone whenever possible.

Residential development will be allowed on a very limited basis as required.

(f) Agriculture Zone

The Agriculture Zone includes lands considered suitable for cultivation, including improved grazing. Such lands are located along the southern boundary of the region. Cultivation of blueberries, cranberries and Saskatoons should also be possible.

(g) Industrial Zone

This zone includes only existing or approved industrial operations. The size of the zone is restricted to that which will practically support the specific development. Since the intensive nature of the zone generally precludes other land uses, it is essentially a single use zone.

Infrastructure and transportation needs are of major concern to this zone, although generally such developments are adjacent to transportation corridors and the required urban facilities. Proposals for additional industrial zoning will normally be subjected to detailed environmental, social and economic review.

(h) Facility Zone

The Facility Zone includes existing or potential urban and commercial development areas as well as lands designated to accommodate intensive facilities necessary for outdoor recreation. Urban areas are primarily confined to the existing major corridors, hamlets, villages or towns. Commercial areas not within the corridors include the existing and potential recreation service centre developments, including visitor accommodation facilities. Additional activities of this type will be permitted in the Multiple Use Zone, subject to the normal regulatory conditions.

Compatible land uses vary depending upon the requirements of the specific development within the zone, although uses such as hunting, trapping, logging and mineral exploration and development will not be permitted.

3.1.2 Development Policy Guidelines

The following is a listing of selective guidelines that were developed by Alberta. They could be applied in the management and development of public lands in the North, subject to relevant legislation. These policy guidelines are directed towards questions of major concern to all Saskatchewan residents rather than just the Northern resident.

(1) Public Input

Proposals for major resource developments, including those for commercial recreation facilities, will be subject to preliminary review for approval in principle by the Provincial Cabinet. Following approval in principle, the needs for public involvement will be considered by Cabinet.

(2) Recreational Townhouse Units

Private developments of recreational townhouse units will be allowed on a controlled basis within the Facility Zone. A condition of approval will require that an appropriate number of units for public rental will be provided at the same location. All necessary services, such as sewage, water, garbage disposal and fire protection will normally be provided by the developer. Under no circumstances will permanent residency be permitted in these developments.

(3) Development Leases

Dispositions for facility and ancillary uses will be by lease rather than sale. Leases issued for major developments may be for terms of up to 50 years. Long-term land dispositions are normally a key requisite to the successful financing of large scale developments.

(4) Off-Highway Vehicle Use and Controls

Vehicle use will be confined to designated roads and trails, except in connection with approved individual activities. All other off-highway vehicle use will be restricted to specific locations where tight controls can be applied. These areas will be designated within the Multiple Use Zone as part of operational level planning.

(5) Recreational Cottages

Cottage developments for recreational use only will be considered for selected areas within the Facility and Multiple Use Zones. Such sites will be developed and managed on a carefully-controlled basis.

(6) Group Camps

Accommodation for group camps will require detailed management planning based upon the Northern (LAC and NMC) zoning and the recommendations for such areas and facilities. The resulting guidelines will ensure a high level of utilization of the camps. Institutional leases for group camps on public lands will be located in designated areas within the Multiple Use, General Recreation and Facility zones where services can be

readily provided. Additional group camps will be provided by Government and will be available to groups for short-use periods on a reservation basis.

(7) Wilderness Park

Clearwater River valley could be designated from Lloyd Lake to Careen Lake but only after further investigation.

(8) Trail System Planning

Trail systems for such purposes as hiking, canoeing cross-country skiing and off-highway vehicle use will be provided in the Multiple Use and General Recreation zones during the more detailed integrated management and operational levels of planning. Conflicts between users will be dealt with at this stage. Detailed policies for commercial and private canoe use should be developed as guides for management planning.

(9) Recreation Priority

A general principle for recreational use will be to optimize its availability for use by people from all walks of life but without interfering with the traditional life styles.

3.1.3 Method for Revising Regional Land Use Zones

In Subsection 3.1.1, a Regional Land Use Zoning system was given. These zonings are broad in nature and cannot be used for detailed management planning. The detailed management plans can be prepared by selecting areas on a priority basis until the whole corridor has been mapped in detail. This priority system allows for revision of the Regional Land Use System based on need.

One method for accomplishing the revision is the overlay system proposed by McHarg (1969) which can be implemented on a GIS. Table 3.2 shows his basic system. The zones are mapped in grey scales of decreasing density from Zone 1 to Zone 3. The system allows for mapping of information that is of neither equal value nor equal quality. The overlays from the first column allow for the determination of areas that would be physiographically destroyed by development or not capable of being developed. The second column zones allows for socioeconomic values to be depicted. Each of the constituent maps is an evaluation within the appropriate class, representing three divisions, with the darkest representing the highest value and the lowest as blank. All fifteen maps should be modelled to superimposed as a composite of summation. This digital map will shows the areas least likely for future development dark and areas most likely for development as blank.

Table 3.2 Detailed Land Use Criteria to Determine Multi-Use Areas

PHYSIOGRAPHIC OBSTRUCTION TO DEVELOPMENT

Slope

Zone 1 Areas with slopes in excess of 10%.
Zone 2 Areas with slopes less than 10% but in excess of 2½%.
Zone 3 Areas with slopes less than 2½%.

Surface Drainage

Zone 1 Surface-water features - streams, lakes and ponds.
Zone 2 Natural drainage channels and areas of constricted drainage.
Zone 3 Absence of surface water or pronounced drainage channels.

Soil Drainage

Zone 1 Salt marshes, brackish marshes, swamps, and other low-lying areas with poor drainage.
Zone 2 Areas with high water table.
Zone 3 Areas with good internal drainage.

Bedrock Foundation

Zone 1 Areas identified as marshlands are most obstructive to the highway; they have extremely low compressive strength.
Zone 2 The Cretaceous sediments: sands, clays, gravels.
Zone 3 The most suitable foundation conditions are available on crystalline rocks: serpentine and diabase.

Soil Foundation

Zone 1 Silts and clays are a major obstruction to the highway; they have poor stability and low compressive strength.
Zone 2 Sandy loams and gravelly sandy to fine sandy loams.
Zone 3 Gravelly sand or silt loams and gravelly to stony sandy loams.

Susceptibility to Erosion

Zone 1 All slopes in excess of 10% and gravelly sandy to fine sandy loam soils.
Zone 2 Gravelly sand or silt loam soils and areas with slopes in excess of 2½% on gravelly to stony sandy loams.
Zone 3 Other soils with finer texture and flat topography.

SOCIOECONOMIC EVALUATION

Historic Values

Zone 1 Richmondtown Historic Area.
Zone 2 Historic landmarks.
Zone 3 Absence of historic sites.

Scenic Value

Zone 1 Scenic elements.
Zone 2 Open areas of high scenic value.
Zone 3 Urbanized areas with low scenic value.

Recreation Value

Zone 1 Public open space and institutions.
Zone 2 Nonurbanized areas with high potential.
Zone 3 Area with low recreation potential.

Water Values

Zone 1 Lakes, ponds, streams and marshes.
Zone 2 Major aquifer and nonurbanized watersheds.
Zone 3 Urbanized watersheds of important streams.

Forests and Marshes of High Quality

Zone 1 Forests and marshes of high quality.
Zone 2 All other existing forests and marshes.
Zone 3 Unforested lands.

Wildlife Values

Zone 1 Best quality habitats.
Zone 2 Second quality habitats.
Zone 3 Poor habitat areas.

Residential Value

Zone 1 Market value over $50,000.
Zone 2 Market value $25,000 to $50,000.
Zone 3 Market value less than $25,000.

Institutional Value

Zone 1 Highest value.
Zone 2 Intermediate value.
Zone 3 Least value.

Mining Values

Zone 1 Multi-mine complex.
Zone 2 Single products mine.
Zone 3 Absence of mineral resources.

Source: McHarg, 1969

These systems can be extended as a classification to revise the land use zones. As an example, when commercial development or transportation corridors are planned to transgress into a Prime Protection Zone, the following constituent values might be employed to reveal areas most suitable for conservation.

High Quality Habitats	Unique Features
High quality forest	Geological features
High quality marshes	Physiographic features
Bay beaches	Ecological association
High quality streams	Historical value

The method for revising the remaining zones is given in Table 3.3.

Figure 3.1 shows an example in grey tone of a combined map. The map is for the highway crossing the Clearwater River at the Warner Rapids. The darker the grey tone, the less desirable the land is for facility development. The whiter areas would be best developed. In the case of Figure 3.1, the only white area is on the Descharme River. This area lacks any forest value because it has no vegetation and also is flat. One quickly sees that a campground on the northeast side of the highway would not be a good proposition unless it is at least 0.5 km from the river. The west side where the aboriginals wish to develop is much more suitable. Possible both could be accommodated with the aboriginal buildings closer to the highway and the campsite 1 km west of the bridge. Another alternative is Sinclair or Murphy Lakes southwest of the bridge. This area has open-crown forest and some areas of low slope. Both of these lakes have trails leading to them and one would expect some occupation already.

Table 3.3 Methods to Revise Classification Zones

1. PRIME PROTECTION ZONES

high quality habitat	unique features
1. forest	5. geological
2. marsh	6. physiographic
3. bay beaches	7. ecological
4. streams	8. historic

2. CRITICAL WILDLIFE ZONES

high quality habitat	unique features
1. forest	6. unique species (animal, plant, etc)
2. marsh	7. high change areas
3. streams	8. human interaction zones
4. lakes	9. slope and orientation
5. animal wintering, migration routes and calving areas	

3. SPECIAL ZONES

designated by legislation

4. GENERAL RECREATION ZONES

passive - features - active
1. unique physiographic
2. scenic water
3. historic value
4. scenic cultural
5. scenic landforms
6. unique geologic

passive	- habitats -	active
7. high quality forest		12. bay beaches
8. high quality marshes		13. expanse of water for pleasure craft
9. unique ecologic associations		14. freshwater areas
10. water associated wildlife		15. riparian lands
11. meadow and forest wildlife		16. flat lands
		17. existing, planned and potential recreation areas

5. MULTIPLE USE ZONE

physiographic:	socio-economic values:
1. slope	1. mining
2. surface drainage	2. historic
3. soil drainage	3. scenic
4. bedrock foundation	4. recreation
5. soil foundation	5. water
6. susceptibility to erosion	6. forest
	7. wildlife
	8. residential
	9. institutional

6. AGRICULTURAL

1. improved grazing areas	4. timber management zones
2. cultivation for cranberries and blueberries	5. wildlife management zones
3. mink farms	

7. INDUSTRIAL ZONES

1. mineral permits
2. mineral claims
3. mineral leases
4. transportation corridors
5. timber leases
6. trapping permits
7. commercial fishing lakes
8. Indian Reservations

8. FACILITY ZONE (residential)

permissive

1. scenic land features
2. riparian lands
3. scenic cultural features
4. good bedrock foundations
5. good soil foundation

restrictive

6. slope
7. forest areas
8. poor surface drainage
9. poor sub-surface drainage
10. erosion potential
11. flooding potential

(commercial)

permissive

1. good soil foundation
2. good bedrock foundation
3. transportation corridors

restrictive

1. slopes
2. forested areas
3. poor drainage
4. poor sub-surface drainage
5. erosion potential
6. flooding potential

74 C/14 | 74 C/15

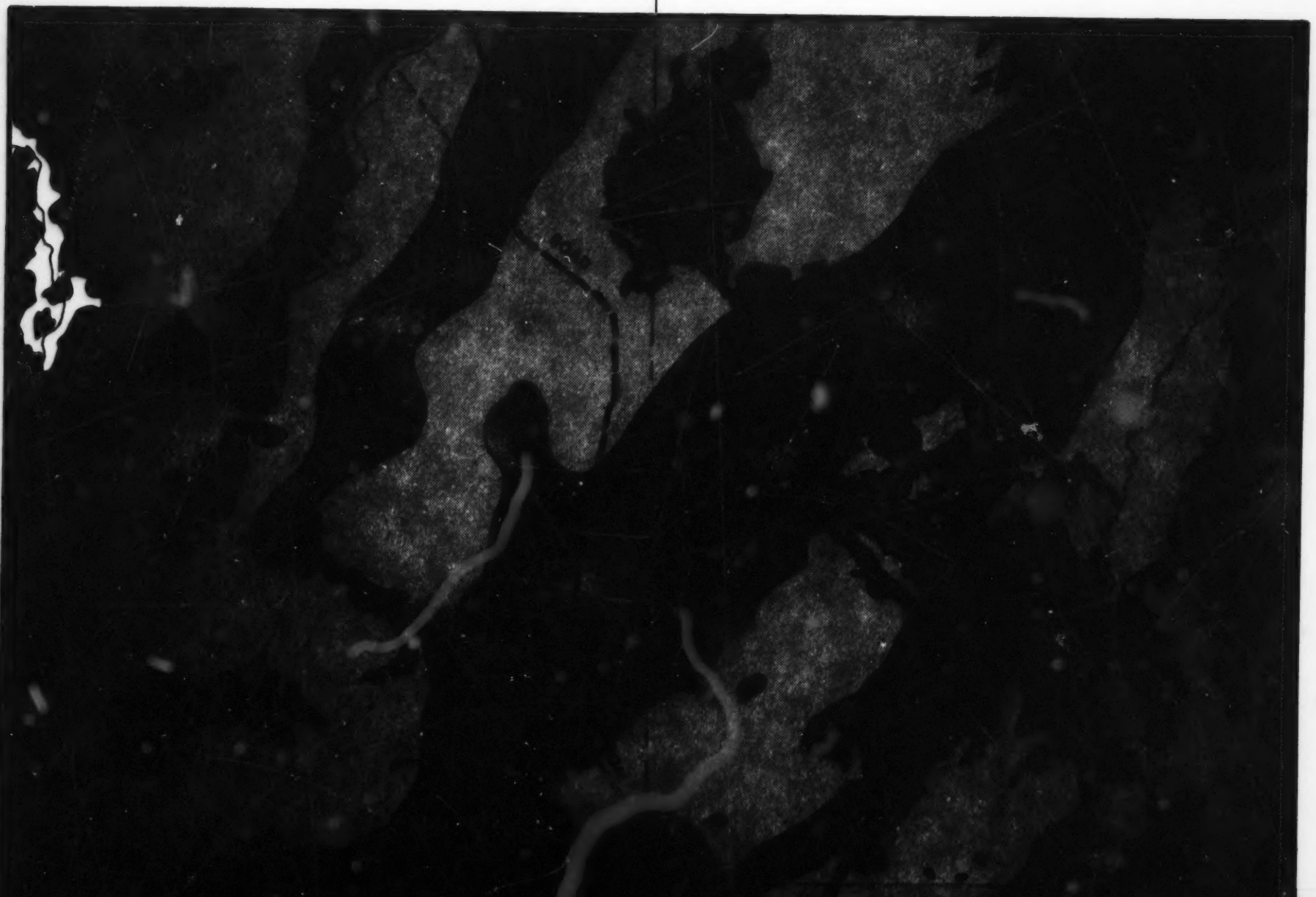


Figure 3.1

DETAILED LAND USE MAP - Warner Rapids

PHYSIOGRAPHIC OBSTRUCTIONS TO DEVELOPMENT

SLOPE

ZONE 1 AREAS WITH SLOPES IN EXCESS OF 10%
2 AREAS WITH SLOPES LESS THAN 10% BUT IN EXCESS OF 2.5%
3 AREAS WITH SLOPES LESS THAN 2.5%

SURFACE DRAINAGE

ZONE 1 SURFACE WATER FEATURES: STREAMS, LAKES AND PONDS.
2 NATURAL DRAINAGE CHANNELS AND CONSTRICTIONS, RAPIDS, ETC.
3 ABSENCE OF SURFACE WATER OR PRONOUNCED DRAINAGE CHANNELS.

SOIL DRAINAGE

ZONE 1 BRACKISH MARSHES, MARSHES, MUSKEG, TREED MARSHES AND OTHER LOW-LYING AREAS WITH POOR DRAINAGE.
2 AREAS WITH HIGH WATER TABLE (WHICH IN FORESTED AREAS MAYBE INDICATED BY BLACK SPRUCE).
3 AREAS WITH GOOD INTERNAL DRAINAGE.

SOCIO-ECONOMIC EVALUATION

FOREST VALUES

ZONE 1 FORESTS OF HIGH VALUE EITHER FOR TIMBER OR RECREATIONAL USE
2 ALL OTHER EXISTING FOREST AND MARSHES
3 UNFORESTED LAND

ZONE 1
ZONE 2
ZONE 3

N

WARNING THESE MAPS ARE TAKEN FROM UN-CHECKED MAPS AND IN SOME CASES ARE AN ARTISTS IMPRESSION.

SCALE 1:50 000

4.0 METHOD TO OPTIMIZE COMPATIBILITY BETWEEN MULTIPLE LAND USE ZONES

To enable decisions to be made in planning, the degree of compatibility must be devised between the multiple uses of the land, and the land use and natural determinants. In addition, the consequences of the development must be shown. McHarg (1969) developed such a system, and this has been adapted to fit northern conditions (Figure 4.1). This figure is in matrix form with prospective land uses of each coordinate. Each land use was then tested against all others to determine the compatibility, incompatibility and any intervening degree.

From this it is possible to reexamine the single optimum and determine the degree of compatibility with other prospective land uses. Thus, for example, an area compatible with water sports in recreation would also be compatible with vacation subdivision and forestry (hardwood), but incompatible with open-pit mining.

Adjacent to the matrix on intercompatibility is a matrix on natural determinants. Again, the same exercise as above was used. For example, an area used for recreation (water sport) would be incompatible with open-pit mining.

Adjacent to the above matrices is a third on the consequences of a certain development. To some extent, it is the environmental result of the single development.

The map system produced for Subsection 3.1 (Figure 3.1) consists of maps of a single use or towards a single aim, as, for example: conservation, passive and active recreation. These have an existence in their own right, but we seek to find only intrinsic single uses, but also compatible coexisting ones and areas of competition. We can then take complementary pairs and reduce them to simple maps. Trapping and timber harvest can be incorporated into a single map of wildlife suitability. Active and passive recreation can be combined into a single one of recreational suitability. We then have a residuum of three maps - conservation, recreation and harvesting - which we must resolve. The single suitabilities could be represented using tones of grey or colour digital GIS maps. We must employ colour. Let us allocate yellow to conservation and reconstitute the tones of grey into a range of brightness. We will map recreation in grades of blue and harvesting in grey.

Where a land use has no conflict, nor is it complementary, we can map the area in its appropriate colour and in a scale of brightness appropriate to its value. Where there are complementarities, such as recreation and conservation, the combination of blue and yellow will produce green and the brightness will reflect the degree of value. The combination of grey and blue - urbanization and recreation - will show in the blue-grey range, while a coequal suitability for all three classes will result in the combination of grey, blue and yellow, producing a range of grey-greens. In the preparation of the final map it is often impossible to resolve the suitabilities, compatibilities and conflicts by superimposition and photography and so the preemptive method will have to be used. This would consist of locating all primary

FIGURE 4.1 Degree of Compatibility Between Renewable Resources and Other Land Uses

	INTERCOMPATIBILITY																			NATURAL DETERMINANTS														CONSEQUENCES				
	RESIDENTIAL	INDUSTRIAL	INSTITUTIONAL	MINING: shaft	MINING: open pit	MINING: abandoned	QUARRYING: stone and limestone	QUARRYING: sand and gravel	VACATION SUBDIVISION	AGRICULTURE: fruit bushes	AGRICULTURE: livestock	FORESTRY: even stand softwood	FORESTRY: uneven stand softwood	FORESTRY: hardwood	RECREATION: water sports	RECREATION: wilderness	RECREATION: general cultural	RECREATION: driving for pleasure	WATER MANAGEMENT: reservoir	WATER MANAGEMENT: watershed	SLOPE: flat	SLOPE: 0.5%	SLOPE: 15.25%	SLOPE: > 25%	VEHICULAR ACCESSIBILITY	SOILS: gravels	SOILS: sand	SOILS: loams	SOILS: silts	AQUIFER RECHARGE	WATER SUPPLY DEPENDENCE	CLIMATE: fog	CLIMATE: inversions	AIR POLLUTION	WATER POLLUTION	STREAM SEDIMENTATION	FLOOD AND DROUGHT CONTROL	SOIL EROSION
RESIDENTIAL	/																			/	R	R	R	/					X	/	R	R	F	B	F	P	P
INDUSTRIAL	R	/																		/	R	X	X	R					R	/	X	X	B	B	B	P	P
INSTITUTIONAL	R	/	/																	/	/	R	R	/					R	R	/	/	F	B	F	F	F
MINING																																						
shaft mining	X	/	X	/																/	/	R	/	X					X	X	R	R	P	B	B	G	G
open pit mining	X	/	X		/															/	R	R	R	X					X	/	R	R	P	B	B	P	B
abandoned spoils	X	/	R			/														R	R	R	R	X					/				G	P	B	B	B
QUARRYING																																						
stone and limestone	X	/	X				/													R	R	R	/	/					R	X	R	R	P	P	B	B	B
sand and gravel	X	/	R					/												/	/	R	/	R		/	/		R	R	R	R	F	F	F	F	P
VACATION SUBDIVISION	/	X	R	X	X	X	X	X	/											/	/	/	R	R					/	/	X	X	F	F	F	F	F
AGRICULTURE																																						
fruit bushes	R	X	R	R	X	R	X	X	/	/										/	/	R	R	R	X	/	R	X	/	/	R	R	G	G	G	G	G
livestock	R	X	X	R	X	R	X	X	X	R	/									/	/	R	R	R	R	R	R	R	X		R	R	G	P	G	G	F
FORESTRY																																						
even stand softwood	X	R	R	R	X	R	X	X	R	X	X	/								/	/	R	X	R	R	R	R	R	R	R	R	R	G	G	G	G	G
uneven stand softwood	R	R	R	R	X	R	X	X	/	/	/		/							/	/	R	X	R	R	R	R	R	R	R	R	R	G	G	G	G	G
hardwood	R	R	R	R	X	R	X	X	/	/	R			X	/					/	/	R	X	R	R	X	R	R	R	R	R	R	G	G	G	G	G
RECREATION																																						
water sports	R	X	R	X	X	/	X	X	/	/	R	R	/	/	/									R					R	/	X	X	G	F	F	G	F
wilderness	X	X	R	R	X	/	X	X	R	R	R	R	/	/	/	/								X					R	R	X	X	G	G	G	G	G
general	/	R	/	R	X	/	X	R	/	/	R	R	/	/	/	/	/							R					R	R	R	R	G	G	G	G	G
cultural	X	X	/	/	X		X	X	R	/	R	R	/	/	/	/		/						R					R	R	R	R	G	G	G	G	G
driving for pleasure	/	X	R	/	X	R	X	R	R	/	/	R	/	/	/	/		/	/					R					R	X	X	X	F	G	G	G	G
WATER MANAGEMENT																																						
reservoir	/	/	/	/	X	R	R	X	R	/	X	R	/	/	/	/	R	/	/	/	/	R	/	X					/	R	X	X	G	F	P	G	P
watershed	X	X	R	/	X	R	X	X	R	/	X	X	/	/	/	/	R	/	/				X	X					/			R	G	G	G	G	G

/ - compatible land uses
R - restricted - uses that may not be compatible under certain circumstances
X - incompatible with either intent or capabilities of land use

G - good P - poor
F - fair B - bad

suitabilities not in competition with any other primary values and mapping them, thus preempting the appropriate areas. This is continued with secondary and tertiary values until the summary map shows all unitary, complementary and competing intrinsic land uses. Those shown as coequally suitable for more than one use may either compete or coexist.

By abandoning absolute economic values that cover only a small range of price values, and employing a relative system of most to least, it is possible to include all of the important factors that defy pricing by economists. While this denies an illusory precision of cost-benefit economics, it does show the relative concurrence of positive factors and their relative absence. Although we are unable to fix precise money values on these, it is safe to assume that, in the absence of any supervening value, the concurrence of the most positive factors in any one location does indicate its intrinsic suitability for the land use in question.

Another value is that the information so compiled and interpreted constitutes the base data required to subject any planning proposal to the test of least cost-maximum benefit. The values of the area in question for the major land uses have been identified, and the degree to which any proposal will destroy or enhance these can be demonstrated. Moreover, these same data simplify the quest for least-social-cost locations. By making explicit the factors employed, it is possible for society at large and for individuals to insist that the development process, both public and private, respond to these values. It would serve a most useful purpose if maps of the value of an area, and the intrinsic suitabilities, were made public so that developers could know where they planned to tread and, more positively, could be led to areas intrinsically suitable for their energies.

Perhaps one of the most valuable innovations of the method is the conception of complementary land uses, the search for areas that can support more than one use. This tends to be in conflict with the principle of zoning, which enforces segregation of land uses. The recognition that certain areas are intrinsically suitable for several land uses can be seen either as a conflict or as the opportunity to combine uses in a way that is socially desirable.

Certain technical problems are inherent in the method. The first of these is the ensurance of parity of factors. The results need to be qualified if the factors are of disproportionate weights. The GIS computer can resolve this problem.

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DNS representative in La Loche, La Ronge, Prince Albert
Sister Demarais of the La Loche Hospital
Outreach representatives in La Loche and Buffalo Narrows
Resource Officers in La Loche, Turner Lake and Buffalo Narrows
Commercial fishermen in La Loche and Descharme Lake
AMNSIS representative in Buffalo Narrows
Dept. of Highways representatives in Buffalo Narrows
Indian Affairs District Representative in Meadow Lake
2 local Outfitters
members of the La Loche L.C.A.
members of the Turner Lake L.C.A.
chairman of the La Loche Fur Council
chairman of the Turner Lake Fur Council

Chief of the Portgage La Loche Indian Band
Town planner for the Portgage La Loche Indian Band
Several trappers from La Loche, Descharme and Turner
members of the L.C.A. in Brabant Lake
Area representative to the Northern School Board
Outfitters along Highways 102 and 105

Minutes of the Buffalo Narrows Local
Meeting of Northern L.C.A. and L.A.C.
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